Expanding Web Access to SPARROW Models

http://water.usgs.gov/nawqa/sparrow

U.S. Geological Survey
National Water Quality Assessment Program
Reston, Virginia USA

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SPARROW Modeling
User Profiles

- Users interested in using existing models
  - Reach-level water-quality assessments (e.g., TMDLs)
  - Simulation of water-quality response to regulatory actions, land-use change
  - Water-quality monitoring network design

- Users interested in calibrating and applying new models
  - Regional water-quality assessment
  - Hypothesis testing

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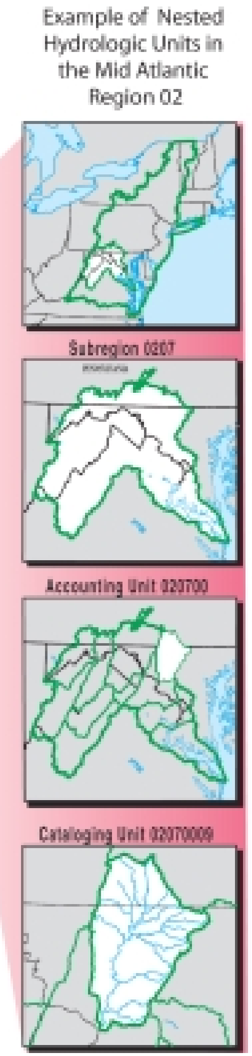
SPARROW WEB

Watershed Data and Model Predictions for 62,000 Stream Reaches (developed by Michael Ierardi)

- Mean-annual streamflow, water velocity, drainage area
- NLCD land use (1992)
- Population, waste disposal type (1990 Census)
- Mean-annual nutrient conditions (yield, concentration, sources, prediction uncertainties)
- Natural background nutrient conditions
- Public release: 2003



Internal URL: http://hqsun2.er.usgs.gov/~mierardi/hucmaster

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Potential Enhancements of SPARROW Models

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Trend Analysis Using SPARROW

- Fundamental difference:
  - 1) application in a <u>simulation</u> mode
  - 2) application in an <u>empirical</u> mode
- In simulation mode, water quality changes are driven by changes in inputs (coefficients are assumed to remain constant).
- In empirical mode, water quality changes are detected in a model calibration.

Trend Analysis Using SPARROW

- Simplest empirical approach is to compare two models calibrated with data sets representing different time periods.
- Differences in predicted water quality can be traced to either changes in inputs (i.e. pollution sources) or model coefficients
- Changes in coefficients imply changes in processes (e.g. agricultural practices, subsurface storage).
- Must use identical model forms.
- A more complex model could include terms for different practices or storage compartments.

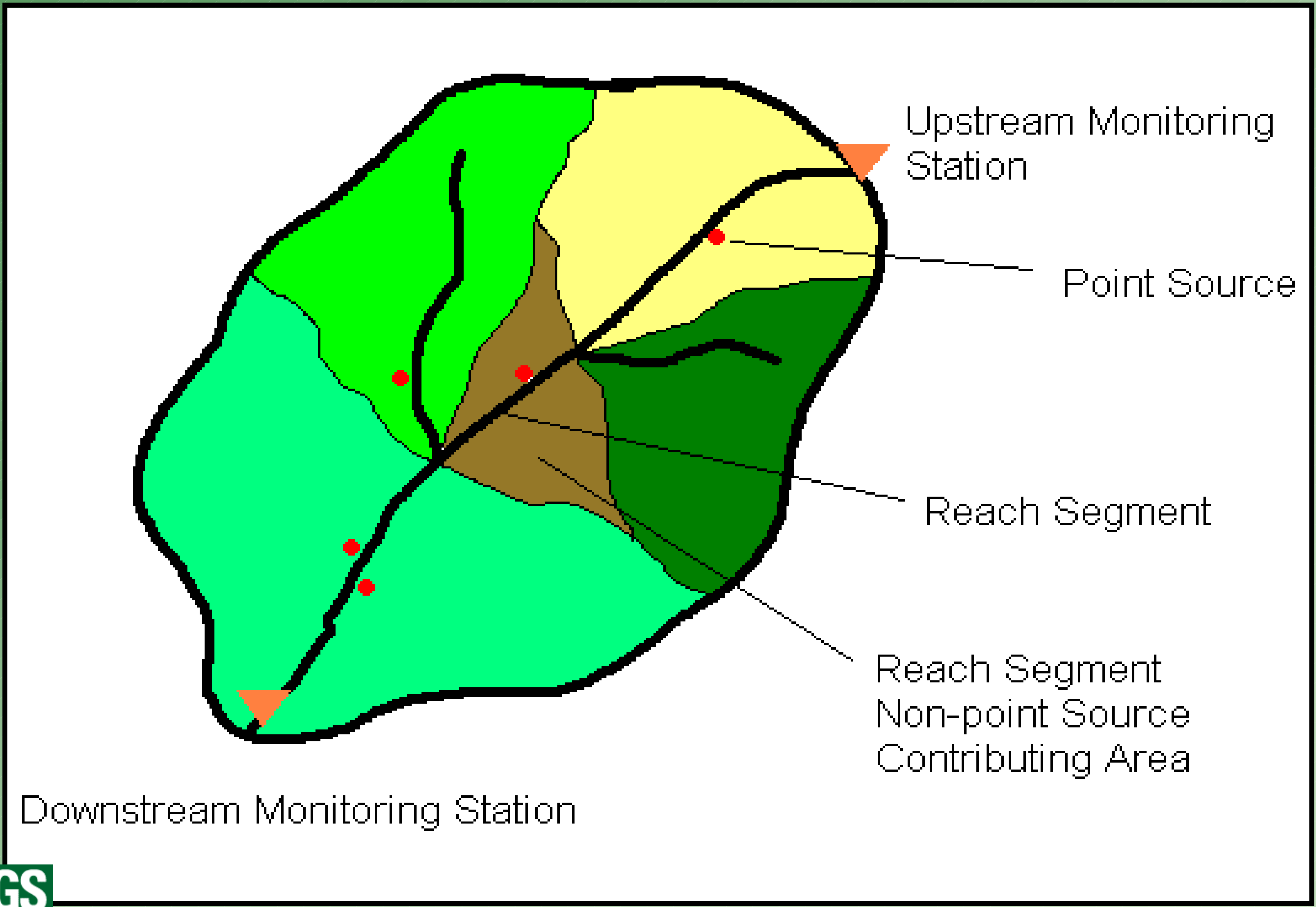
Modeling Biological Systems With SPARROW

- Will generally require change from mass balance approach (i.e. in-stream flux rate is not the issue).
- Modeling algal biomass may be the logical starting point.
- But models of invertebrate or fish community metrics may be as successful.

Modeling Biological Systems With SPARROW (continued)

- Modeling animal community processes may offer some interesting opportunities related to stream networks, the backbone of SPARROW models.
  - Stream tributaries often serve as places of refuge for stressed fish populations (both upstream and downstream of a given reach).
  - Upstream reaches serve as potential sources of replenishment for benthic invertebrates in downstream reaches

How is SPARROW structured?



Future Enhancements to SPARROW

- Evaluate statistical support for additional model complexity:
  - Landscape variables (e.g., TOPMODEL ests. overland flow)
  - Nitrogen:
    - --multiple N species (nitrate, ammonia, organic N)
    - --in-stream processing ~ f(nitrification, denitrification, depth, concentration, temperature, particulate settling and burial)
    - --seasonal flux
- Temporally dynamic model of nutrient sources
  - Interannual time scale
  - Explicit description of nutrient storage
  - Data limitations (small-scale application first)

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Future Enhancements to SPARROW

- Streamflow SPARROW model
- Nested SPARROW modeling techniques
  - National model coupled with regional monitoring and watershed data
  - National coefficients serve as baseline conditions
- Nesting of mechanistic models in SPARROW infrastructure
  - Whole model, model components, model predictions (e.g., SWAT, regional GW model, INCA)
  - Hypothesis generation and testing
  - Exploring model complexity (e.g., agricultural management components)
- Linking SPARROW to estuarine models (e.g., NOAA)

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